DOCUMENT RESUME

ED 475 713 TM 034 877

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|---|---|
| AUTHOR | Kim, Younghoon; Grabowski, Barbara L.; Song, Hae-Deok |
| TITLE | Science Teachers' Perspectives of Web-Enhanced Problem-Based Learning Environment: A Qualitative Inquiry. |
| SPONS AGENCY | National Aeronautics and Space Administration, Washington, DC. |
| PUB DATE | 2003-04-00 |
| NOTE | 10p.; Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL, April 21-25, 2003). |
| PUB TYPE | Reports - Research (143) -- Speeches/Meeting Papers (150) |
| EDRS PRICE | EDRS Price MF01/PC01 Plus Postage. |
| DESCRIPTORS | Educational Practices; *Middle School Teachers; Middle Schools; *Problem Based Learning; Qualitative Research; Science Instruction; *Science Teachers; *Teacher Attitudes; *Web Based Instruction |
| IDENTIFIERS | *Student Engagement |

ABSTRACT

This study investigated and described the perspectives of science teachers who integrated a Web-enhanced problem-based learning model into their classrooms. The study examined: (1) teachers' pedagogical beliefs; (2) the roles of teachers; (3) the use of Web resources; and (4) the degree of increased student engagement. This qualitative study used in-depth interviews and classroom observations of five middle school teachers. Data from the interview and observation were examined to determine the relationship of teachers' perceptions of themselves as teachers and their teaching practice. Results imply that the successful integration of an innovative learning program with the use of technology may depend greatly on how teachers relate what they have believed about their own teaching practices to new teaching approaches. An appendix contains the interview protocol. (Contains 18 references.) (Author/SLD)

# Science teachers' perspectives of web-enhanced problem-based learning environment: A qualitative inquiry

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Article submitted for presentation at the 2003 American Educational Research Association, Chicago, Illinois

April, 2003

Running Head: Web-Enhanced Problem Based Learning

# Science teachers' perspectives of web-enhanced problem-based learning environment: A qualitative inquiry

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## Abstract

*The purpose of this study was to investigate and describe perspectives of science teachers who integrated a web-enhanced problem based learning into their classrooms. We were examining teachers' (1) pedagogical beliefs, (2) the roles of teachers, (3) the use of web resources, and (4) degree of increased students' engagement. This qualitative study used an in-depth interview and classroom observation involving five middle school teachers. The data from interview and observation were interrelated to examine the interrelationship of teachers perceptions of themselves as teachers and teaching practice. The results of this study and implications for research and design of technology-supported learning environments were discussed.*

## Introduction

Problem-based learning as an instructional model is associated with the new learning-centered paradigm (e.g., Reigeluth, 1999). PBL, in general, encourages the students to develop deep understanding within a knowledge domain and problem solving skills by engaging them in the learning process with activities in which they solve real world, authentic problems (Duffy & Cunningham, 1996; Hmelo & Evensen, 2000). According to PBL researchers, PBL has the following critical features associated with the principles of the learning- centered approach (Barrows, 1986; Dahlgren; Duffy & Cunningham, 1996; Savery & Duffy, 1995):

- *Learning goals*: Students are encouraged to construct a disciplinary knowledge base in a content domain and develop problem solving skills including metacognitive skills.
- *Authentic problem*: A real problem is used as a motivational context to drive learning and as a stimulus for authentic activity. A problem should be ill-structured and has multiple solutions.
- *Self-directed learning*: Students should have ownership of the problem and take responsibility for their learning to solve a problem.
- *Active learning*: With the ownership of the problem and problem solving process, students actively engage in learning by doing situations.
- *Collaborative learning*: Students work with their peers to share their perspectives and knowledge in the problem solving process. Through collaborative learning, students articulate their understanding or ideas and reflect their learning processes.
- *The teacher's role as facilitator*: Teachers play a role as coach or facilitator that provide students with scaffolding strategies that support students to develop higher order thinking and problem solving skills and help them to become independent learners.

PBL has been implemented in diverse content domains such as medical education, business education, social education, and science education. In a middle school science and mathematical education setting, the Jasper Woodbury problem solving series developed by the Cognition and Technology Group at Vanderbilt (CTGV) has been successfully implemented. According to CTGV (1990, 1991, 1992), the Jasper Series was based on anchored instruction with a problem-based learning perspective and video based programs. They found that this program enhanced students' construction of knowledge, transfer of problem solving skills, and motivation. The use of an authentic problem in the Jasper Series was especially powerful in promoting students' interest and positive attitudes toward math and science learning.

Achilles and Hoover (1996) investigated the middle and high school teachers' perceptions and feedback from their PBL experience. In this study, teachers reported that PBL made learning more exciting and was a useful model for encouraging students' communication and social skills necessary to work together with peers in a learning group.

Recent research on teachers teaching with the use of technology in different content domain has emphasized that teachers' integration and use of technology in classroom are greatly influenced by their educational beliefs about teaching and learning (Carr-Chellman & Dyer, 2000; Cope & Ward, 2002; Ertmer, Ross & Gopalakrishnan, 2000; Gallini & Barron, 2001-2002; Pierson, 2001). As an example, in Ertmer, Ross and Gopalakrishnan's (2000) study of seventeen exemplary technology-using teachers, they reported that teachers' pedagogical beliefs about learner-centered classroom led to meaningful technology use in their classroom. These results imply that the teachers' pedagogical issues about instruction and learning are critical to successfully using and integrating technology into their classrooms.

This study extends previous work in that it focuses on science teachers' perceptions of their own experiences in the context of a web-enhanced PBL environment. In this study, the data was based on an extended (one semester) teaching experience. Thus, the purpose of this study was to determine if pedagogical beliefs and teaching approaches are linked to teachers comfort with using web-enhanced PBL. We were particularly interested in investigating teachers' pedagogical beliefs, teaching practice, and the interaction between these two as they relate to their web-enhanced PBL experience. We also sought to find out whether teaching practice and experience in web-enhanced PBL led teachers to change their teaching approaches in science teaching.

## Research Methods

### Tradition of Inquiry: Phenomenology

To understand the meanings and perspectives of science teachers, the framework of this study used a phenomenological research methodology. The theoretical framework of phenomenology provides an appropriate fit for the purpose of the study. According to Creswell (1998), phenomenology searches for "the meaning of the lived experiences for several individual about a concept or the phenomenon" (p.51). Phenomenology focuses on how and what meaning people construct in particular situations (Moustakas, 1994). Therefore, this phenomenological study attempts to describe and interpret the perspectives, beliefs, and practice of teachers using web-enhanced PBL.

### Participants

Five teachers who expressed interest in implementing web-enhanced PBL developed by the researchers were selected from a northwestern Pennsylvania school district. Three of the teachers taught sixth grade, one taught seventh and one taught eighth grade using the web-enhanced PBL. The demographical information of five teachers is described in Table 1.

Table 1. Demographics of five teachers (names are pseudonyms)

| Teacher | Years teaching | Grade level | Teaching certificate | Primary subject(s) taught |
|---|---|---|---|---|
| Mary | 11 | 6 | Elementary /reading | All subjects |
| Jill | 17 | 6 | Elementary | All subjects |
| Susan | 8 | 6 | Elementary/library | Social science |
| Nancy | 4 | 7 | Science | Science |
| Christine | 24 | 8 | K-12/Physics & Health | Science |

### The Context of the Study

Web-enhanced PBL was implemented at three middles schools in a rural Pennsylvania school district. Five different classrooms from these schools were actively involved (Three classrooms were located at one school in the West area, one classroom at one school in the East area, and one classroom at one school in the North area). The classrooms at both West and North were more roomy and modern than the school in the East.

Most teachers taught web-enhanced PBL at least twice a week and each lasting 45 minutes. However, the numbers of web-enhanced PBL implementation at each class were different. It took an average of three to four class periods to complete each lesson plan. There was only one teacher

who taught all 14 web-enhanced PBL lesson plans. The rest of teachers taught several lessons that fit their curriculum needs. The total number of hours of classroom implementation were different for each teacher (Mary =48 hours, Jill =27.8 hours, Susan =10.5 hours, Nancy= 17 hours, and Christine=24 hours).

Nancy and Christine taught web-enhanced PBL in a science classroom and the rest of teachers in a standard classroom. The science classrooms were full of science equipment and lab stations. Students sat at long lab tables or desks in the back of the room. Although there were several computers in the science classrooms, students often went to the computer lab because teachers wanted each student to explore web resources on their own. Two of three standard classrooms were similar because they were at the same school. Both teachers' classrooms were large, roomy, and light. Students sat in small groups and used shelves around the classroom to keep their web-enhanced PBL project work. There were also several computers in their classrooms. Mary's classroom was small and cluttered. Although the classroom was very small, there were more laptop computers there than other classes.

The Web-enhanced PBL program (See web site at http://www.higp.hawaii.edu/kaams/newindex.html) was called KaAMS (Kids as Airborne Mission Scientists). This site was used by the teachers for four months of the 2002 Spring semester. This learning program was designed and developed based on the principles of problem-based learning as a learning-centered paradigm that integrated of a variety of web resources. KaAMS, as a NASA funded project, was developed to help teachers inspire middle school students to learn science. In this program, the students participate as scientists investigating environmental problems using NASA airborne remote sensing data (Grabowski, Koszalka, & Kim, 2002).

The KaAMS program consists of two modules, one about "active lava flows" and the other about "the health of the coral reefs in Hawaii." The module of active lava flow consists of 12 lesson plans and the module of the coral reefs has 14 lesson plans that teachers can flexibly use in their classroom. In both modules, the learning process in which students engage consisted of four problem based learning stages: 1) problem scenario, 2) propose ideas/search information, 3) conduct mission/collect and analyze data, and 4) propose solutions. In the first learning stage, a problem is introduced for students to investigate the location of active lava flow. The problem encourages students to begin the process of exploration by having them develop an understanding of key concepts such as aeronautics and remote sensing. The second learning stage encourages teachers and students to propose their initial ideas of what they need to know to solve the problem and the process they will use to go about solving the problem. At this point, they also explore existing NASA web resources to understand the basic science domain knowledge necessary to solve the problem. In the third learning stage, students are prompted to think about how to collect and analyze data using various NASA web resources such as photography and remote sensing images. Finally, students write their solutions; each student group presents the best solutions they made and share them with other students and teachers. Students then can revise their solutions based on feedback from their peers and teachers. Through the entire learning processes of KaAMS, a variety of learning activities supported students' understanding of scientific principles to solve a given problem (See Figure 1)

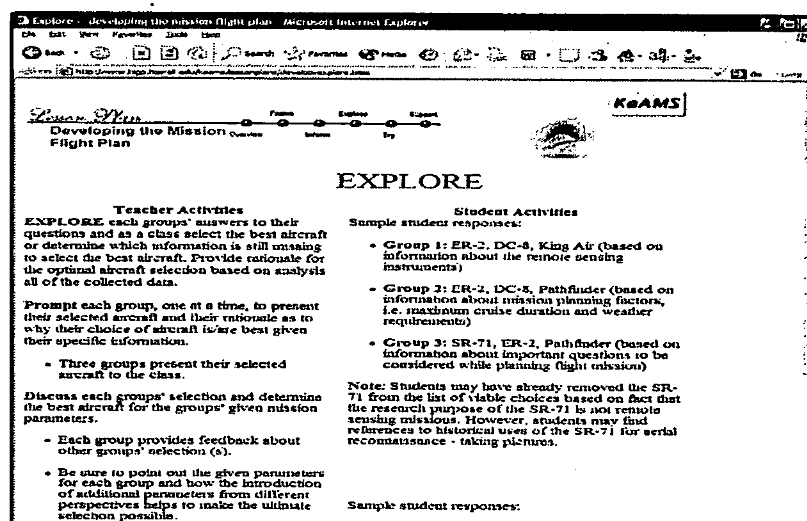


Figure 1. A screen of web-enhanced PBL: KaAMS

**Data Collection**

The two tools that were used to collect data in this study were classroom observation and in-depth interview. In order to understand the context in which teachers implemented the web-enhanced PBL in their classroom, all five teachers were observed two or more times per month for four months of the 2002 Spring semester. The researchers observed the implementation of web-enhanced PBL in an unobtrusive location within the classroom while keeping field notes of classroom activities. The interaction between researchers and teachers or researchers and students were limited so as not to interrupt the follow of KaAMS implementation. Each observation was conducted over a one hour time period and field notes were taken during each observation. Main items written in field notes were teacher's teaching approach, classroom environment, and students' behaviors. The classroom observation allowed the researchers to discover the teaching practice. The information obtained during observation was considered in the in-depth interview process.

An in-depth interview was used as the second tool in this study to investigate teachers' perspectives and perceptions during their implementation of KaAMS. According to Marshall and Rossman (1999), the purpose of an in-depth interview is to explore the meanings of a concept or phenomenon that participants have experienced. They also note that "qualitative in-depth interviews are much more like conversations than formal events with predetermined response categories" (p.108). A series of guided questions for an in-depth interview were designed to focus on teachers' perspectives about (1) pedagogical beliefs, (2) the roles of teachers, (3) the use of web resources, and (4) degree of increased students' engagement in web-enhanced PBL environment. See Appendix A.

Five teachers were interviewed two times in their classrooms at the end of the 2002 Spring semester. The first in-depth interview was conducted with guided questions as described above. The second follow-up interview was conducted to enable the teachers to elaborate on their meaning and perspectives provided in the first interview. Each interview lasted approximately an hour and was audiotaped and transcribed. The in-depth interview enabled us to investigate teachers' pedagogical beliefs, teaching practices, and the interaction between these two as they relate to their KaAMS experience.

**Data Analysis**

The data from the interviews and observations were analyzed by the researchers using a phenomenological research approach (e.g., Patton, 1990). The researchers began by finding common themes that represented each teacher's meaning and perspectives about their experience with web-enhanced PBL and identify the major categories. In order to interpret the essence of meaning that teachers have experienced, we then developed individual structural descriptions by briefly describing each of the participants and by using quotes from their interviews.

## Results

**The Results of Classroom Observation**

First of all, it was observed that teachers showed a reluctance to adopt the new teaching approaches and activities recommended in web-enhanced PBL at the beginning. However, they seemed to gradually integrate the new teaching approaches into their established teaching practice. For example, Christine has been teaching in the middle school classroom for 24 years. This suggests that she has already developed his/her own teaching approaches. In fact, she expressed her concern about KaAMS when he/she used it in the class. She acknowledged that most strategies were very different from the methods that she used to teach in the classroom. However, she justified the discrepancy between her established teaching approaches and the new teaching methods by incorporating her own teaching strategies in the KaAMS teaching. In other words, she put her own teaching mark on the KaAMS lessons. The concern about integrating this new method into the science classroom seemed to be less critical for teachers who were willing to incorporate various instruction strategies in their teaching practice. For example, teacher Susan was used to using a team teaching strategy in her science class. She had been working together with both the Reading and English teachers for the past two years and used KaAMS for her team teaching. Various web resources presented in the KaAMS provided more information resources to not only the teacher but also the other teachers involved in team teaching. The willingness to use the new methods in their class seemed to be one of important factor that could lessen a teacher's reluctance.

We also observed that there were different levels of facilitation skills according to teachers' teaching experiences. It was very interesting to compare the facilitation skills between an experienced teacher and a novice teacher on the web-enhanced PBL. For example, two teachers, Mary and Nancy, played a role as a facilitator to support students' learning activities in the web-enhanced PBL environment. However, the experienced teacher, Mary, took more active roles in facilitating students learning than the novice teacher Nancy. The experienced teacher, Mary, incorporated appropriate instructional strategies, specifically, questioning, to make the web-enhanced PBL more student-centered; whereas, the novice teacher, Nancy, had mainly used the instructional strategies recommended in KaAMS.

One of the findings from the classroom observations showed that teacher preparedness was one of the critical factors to make web-enhanced PBL successful. For example, the teacher Mary printed all the images from web sites for her teaching. This preparation led to a successful teaching experience because the prints were used when the Internet was not accessible. This suggests that the use of web resources can be effective only if they are well prepared in advance.

Students in the five classes seemed to be very comfortable with exploring web resources, discussing the problem with group members, and presenting their findings to the class. They also seemed to be familiar with various learning activities such as small group work and hands-on activities.

**The Results of In-Depth Interview**

The meaning and perspectives of science teachers who implemented web-enhanced PBL, derived from in-depth interview, are described using four themes: 1) pedagogical beliefs, 2) the roles of teachers, 3) the use of web resources, and 4) degree of increased students' engagement.

**Pedagogical Beliefs.** The expressed beliefs of all of the teachers were closely related to some characteristics of the web-enhanced PBL environment that focused on authentic problem solving, collaborative learning, and promoting students' thinking. They perceived that web-enhanced PBL allowed them to do what they believe and to teach in the way they wanted to teach.

*"I think it [teaching] should be real-life and it should be problem-based and problem solving…When you can engage kids in hands-on or real-life situations, that's one of the best way to teach science." (Teacher Jill)*

*"I believe kids do learn much better when they work together and when they help each other…KaAMS allowed me to continue to use group work or cooperative research." (Teacher Susan)*

*"My personal philosophy of science education is to teach kids thinking…That's why I keep KaAMS." (Teacher Mary)*

**The Roles of Teachers.** One teacher expressed that the web-enhanced PBL environment had changed her role in teaching science. She has changed her role from a didactic one to that of a facilitator.

> *"I certainly changed my roles. I taught science with lecture. I was in front. Kids were sitting in and interacting with their books. In KaAMS, I pretty much facilitate what kids are heading to a given day and what kids are doing in cooperative learning." (Teacher Nancy)*

Another recognized that she should be a facilitator or co-learner to work with students, guide cooperative learning, and encourage students to find appropriate information needed to solve a problem from websites.

> *"I move around groups, encourage a couple of kids who are not good at group work, talk with them about how to work together, and get them to solve a personal problem in working together…I facilitate kids who are sitting back and going little bit further." (Teacher Mary)*

However, others perceived that they were not comfortable with a new role to be facilitator, coach, or supporter in web-enhanced PBL environment or they felt that web-enhanced PBL environment they

implemented requires them to do more works or instructional activities than they normally would do in their regular science classrooms.

> *"I am a person who needs to feel control. I want to control…It's very stressful for teachers because teachers have to make sure that all kids are getting something done or what they are doing…It's extremely hard… also it takes a lot of work." (Teacher Christine)*

> *"I could not do it all the time. I go back to what I do in my regular classroom." (Teacher Jill)*

**The Use of Web Resources or the Internet.** Teachers perceived that using web resources or the Internet make students' learning more dynamic and active and motivate students to actively engage in their learning process, particularly problem solving process.

*"Using the Internet, they are able to get clear pictures of what people do day to day…I am really enjoying using technology because it inspires and motivates kids. They not only get information, but solve a problem using technology." (Teacher Mary)*

*"Using web resources motivates them. It gives availability so they can look at not only information but the involved problem solving process at the same time. They can go and find tools or information they need to solve a problem." (Teacher Nancy)*

*"Web resources helps kids do research or problem solving because kids get multiple resources from Web. Kids are able to use them for their research." (Teacher Jill)*

Although they believed that the use of web resources or Internet leads to increased students motivation in engaging in their learning process, they expressed their concerns and preparedness in using web resources or Internet for their instruction.

*"It's difficult in that you never know when computer is going to down or when websites don't work." (Teacher Nancy)*

*"Kids don't get enough instruction in using technology or web resources in effective manners in their learning. I like having that structure like KaAMS lesson plan to teach kids." (Teacher Mary)*

However, all of them pointed out that it is critical to have support from their school administration to use Internet technology. Two teachers of them felt strongly supported by their schools.

*"The most important thing is the availability of technology…I have supports from my school and administrators." (Teacher Mary)*

*"I felt that I need more computers in my room. After I told administrators how important it is…I had them" (Teacher Christine)*

**Degree of Increased Students' Engagement.** Teachers perceived that web-enhanced PBL they experienced promotes students to actively engage in communication or interaction between them or students and teachers. They also felt that they engaged in interactive communication to learn together.

*"Kids work collaboratively. They are getting better at considering conversation. I think kids enjoy talking about their learning they experienced. If they have an idea, they pass it around, and talk about whether it's good idea or not. It's amazing. They learn from each other in that way." (Teacher Susan)*

*"I interact with students…It was interesting that we both are learning together. We are learning at the same time. If I don't know that answer, they go together and find it." (Teacher Jill)*

## Conclusion

The purpose of this study was to investigate teachers' pedagogical beliefs, teaching practice, and the interaction between these two as they relate to their web-enhanced PBL experience and to find out whether teaching practice and experience in web-enhanced PBL led teachers to

change their teaching approaches in science teaching. The results of this study implies that successful integration of an innovative learning program with the use of technology like KaAMS into the classroom may depend much on how teachers relate what they have believed about their own teaching practice to new teaching approaches. This is an important distinction from examining how well they follow new teaching approaches suggested. From the classroom observation and in-depth interview, teachers showed that they made a connection and balanced their established teaching practice with new teaching approaches in order to effectively implement web-enhanced PBL. Second, it appears important to provide teachers with specific information or guidance about how to flexibly use or incorporate a variety of instructional approaches suggested in a new innovative learning program. The guidance can be embedded in the program so that teachers can understand how and why a teaching approach should be used to make teaching effective. Finally, it implies that implementing an innovative learning program in their classroom can provide teachers with a valuable opportunity to reflect and change their current teaching approaches or create their own teaching practice to support students to engage in their meaningful learning process and to construct meaningful learning experiences. Much more research to create a thicker description of the Web-Enhanced PBL classroom is needed to tease out some of the more fuzzy relationships between teaching beliefs and actual teaching practice.

*Acknowledgement*

*This project was made possible through funding from the National Aeronautics Space Administration, Leading Educators to Applications, Research, and NASA-Related Educational Resources in Science (LEARNERS), a Cooperative Agreement Notice from the NASA Education Division and Learning Technologies Project. Project Number: NCC5-432: Learning Using ERAST Aircraft for Understanding Remote Sensing, Atmospheric Sampling and Aircraft Technologies, (LUAU II). In addition, the authors would like to acknowledge the efforts of a multitude of individuals who have contributed to this project, especially, the co-principal investigator, Dr. Luke Flynn of the University of Hawaii, Department of Geophysics.*

**References**

Achilles, C.M., & Hoover, S.P.(1996). *Problem-based learning (PBL) as a school- improvement vehicle* (ERIC document Reproduction Service No. ED 401631)

Barrows, H.S.(1986). A taxonomy of problem based learning methods. *Medical Education*, 20-481-486.

Carr-Chellman, A.A..& Dyer, D. (2000). The pain and the ecstacy: Pre-service teacher perceptions on changing teacher roles and technology: *Educational Technology and Society*, 3(2).

Creswell, J.W. (1997). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, California: Sage.

Cognition and Technology Group at Vanderbilt. (1990). Anchored instruction and its relationship to situated cognition. *Educational Researcher, 19*, 2-10.

Cognition and Technology Group at Vanderbilt (1991). Technology and the design of generative learning environment, *Educational Technology, 31*, 34-40.

Cognition and Technology Group At Vanderbilt (1992). The Jasper Series as an example of anchored instruction: Theory, program description, and assessment data. *Educational Psychologist, 27*(3), 291-315.

Cope, C., & Ward, P. (2002). Integrating learning technology into classrooms: The importance of teachers' perceptions. *Educational Technology & Society*, 5(1), 67- 74.

Duffy, T.M., & Cunningham, D.J.(1996). Constructivism: Implications for the design and delivery of instruction. In D.H. Jonassen (Ed.). *Handbook of Research for Educational Communications and Technology*. New York, NY: Simon & Schuster Macmillan.

Ertmer, P. A., Ross, E.M., & Gopalakrishman, S. (2000). Technology-using teachers: How powerful visions and student-centered beliefs fuel exemplary practice. *Paper presented at conference of Society for Information Technology and Teacher Education conference.* Nashville, Tennessee.

Galline, J., & Barron, D. (2001-2002). Participants' perceptions of web-infused environments: A survey of teaching beliefs, learning

approaches, and communication. *Journal of Research on Computing in Education*, 34(2), 139-156.

Grabowski, B.L., Koszalka, T., & Kim, Y.H. (2002). Designing problem-based lesson plan structures for middle school teachers: Using NASA missions to inspire Kids as Airborne Mission Scientists (KaAMS). *Paper presented at the meeting of the American Educational Research Association.* New Orleans, LA.

Hmelo, C.E., & Evensen, D.H. (2000). Problem-Based Learning: Gaining Insights on learning Interactions Through Multiple Methods of Inquiry. In D. H. Evensen and C.E. Hmelo (Eds.). *Problem-Based Learning: A Research Perspectives on Learning Interactions.* Mahwah, N.J: Lawrence Erlbaum Associates.

Koszalka, T., Song. H., & Grabowski, B.L. (2002). Examining learning environmental design issues for prompting reflective thinking in web-enhanced PBL. *Paper presented at the meeting of the American Educational Research Association.* New Orleans, LA.

Marshall, C.,& Rossman, G.B.(1999). *Designing qualitative research (3rd ed.)*. Thousand Oaks, California: Sage.

Patton, M.Q.(1990). *Qualitative evaluation and research methods (2nd ed.)*. Newbury Park: Sage.

Pierson, M.E. (2001). Technology integration practice as a function of pedagogical expertise. *Journal of Research on Computing in Education*. 33(4), 413-430.

Reigeluth, C. M. (1999). *Instructional Design Theories and Models: A New Paradigm of Instructional Theory* (Volume II). Mahwah, NJ: Lawrence Erlbaum Association.

Savery, J.R., & Duffy, T.M. (1995). Problem-based Learning: An instructional model and its constructivist framework. *Educational Technology*, 35(5), 31-35.

**Appendix A**

In-Depth Interview Protocol

Pedagogical beliefs

1. Do you think the use of web-enhanced PBL have influenced your teaching philosophy or belief? If so, describe it?

The roles of science teacher in new learning centered paradigm

1. Do you think the use of web-enhanced PBL has changed your roles in your classroom? If so, describe some changes you experienced?

Instructional approaches

1. How do you feel about the teaching strategies suggested in web-enhanced PBL?
2. Do you think the use of teaching strategies suggested in web-enhanced PBL have encouraged students to engage in more active and meaningful learning? If so, describe your experience regarding this. If so, how?

Instructional practices (the use of web resources or the Internet)

1. How do you feel about the use of web-resources or the Internet in your teaching?
2. Do you think the use of web-resources or the Internet has influenced students' motivation and interest? If so, how?
3. Do you think the use of web-resources or the Internet has changed the degree of communication, type of interaction between teachers and students, and student and students? If so, how?

Perceived degree of students' engagement in science learning

1. Do you think the use of web-enhanced PBL has influenced students' engagement in their learning processes? If so, how?
2. Do you think the use of web-enhanced PBL has influenced students' interest and motivation in science learning? If so, how?

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